Annual Report 1984

Forest Products and Forest Industrial Development Research Program

Alberta
ENERGY AND NATURAL RESOURCES

Alberta
ECONOMIC DEVELOPMENT

ALBERTA RESEARCH COUNCIL

To:
Mr. F.W. McDougall
Deputy Minister of Energy and Natural Resources
Edmonton

Mr. D.J. Gendall
Deputy Minister of Economic Development
Edmonton

Dr. R.W. Stewart
President, Alberta Research Council
Edmonton

Sirs:

I have the honor to present the Annual Report relating to the Forest Products and Forest Industrial Development Research Program for the fiscal year ending March 31, 1984.

Respectfully submitted,

J.A. Brennan, Chairman,
Management Committee
Forest Products and
Forest Industrial Development
Research Program

Table of contents

Highlights 1

Background 2

Management Committee 3

Program objectives and guidelines 4

Strategic studies projects 5

Forest products research and development projects 12

List of published reports 21

Summary of expenditures 22

Highlights

The fiscal year 1983/84 marked the second year of operation for the Forest Products and Forest Industrial Development Research Program. The program comprised two elements — strategic studies and forest products research and development. This annual report covers the period April 1, 1983 to March 31, 1984 and contains details of each project carried out during the year. Highlights include:

- completion of seven strategic studies projects (four of which were carried over from 1982/83): chemical, thermal, mechanical pulp (CTMP) from aspen in various states of decay; processing of aspen into Japanese veneer and plywood; kiln drying aspen lumber dip treated with water-soluble polymers; feasibility of producing mechanically laminated wood beams from aspen and softwood lumber; market assessment for poplar products; evaluation of Alberta's secondary forest products manufacturing industry; to determine the competitiveness of the Alberta versus the U.S. southeastern forest industry.
- the introduction of a novel wood treatment process in Alberta that shows promise in upgrading aspen and softwoods.
- it is technically feasible to produce up to 20-foot, mechanically laminated beams from aspen and SPF lumber, but currently uneconomic compared to 2 x 12 Douglas-fir joists;
- good quality Japanese plywood can be manufactured from aspen, but recovery was low indicating high degree of rot and need to high grade logs prior to processing;
- poplar market assessment study identified printing paper and medium-density fiberboard (MDF) as suitable products for Alberta and both are currently being considered by Alberta companies;
- decision to purchase three conditioning rooms for the Alberta Research Council laboratory;
- Alberta Research Council received accreditation from Canada Mortgage and Housing Corporation (CMHC) for its testing laboratory;
- a platten system for laboratory manufacture of corrugated wafer-board was developed;
- further testing of the machine stress rating equipment carried out in the form of actual mill trials;
- patent searches underway for two separate pieces of equipment developed at Alberta Research Council.

Background

Alberta's forest and forest products primary industries are an important economic force, accounting for more than 11 percent of manufacturing-sector employment in the province and generating roughly $724 million worth of products in 1982. The province's forest resources, however, in terms of both softwood (spruce and pine) and hardwood (aspen and balsam poplar), are far from fully developed. As a result, only about one-third of Alberta's annual allowable cut is currently used.

It has been estimated that in addition to the 7 million cubic metres of softwood currently harvested every year in Alberta, another 20 million cubic metres of softwood and hardwood could be cut annually on a sustained yield basis. This potential harvest could dramatically increase manufacturing opportunities in such fields as structural wood products, pulp and paper, energy, wood-based industrial chemicals and feed products.

One of the major reasons for under-utilization of Alberta forests has been the presence of vast stands of poplar, a hardwood considered unmerchantable because of its unsuitability for conventional forest products such as lumber, veneer and pulp and paper. In recent years, however, the Alberta government has become increasingly aware of the potential of this virtually untapped resource. Accordingly, planning began for a comprehensive program aimed at not only solving the problem of poplar utilization, but also enhancing development of Alberta's forest as a whole.

Two components were envisioned: a number of strategic studies designed to determine the quality of the forest resource in Alberta and to investigate market opportunities, and an ongoing forest products research and development program focused primarily on the hardwood resource.

Impetus for the program came from the three provincial agencies primarily concerned with the development of Alberta's forest industry: Alberta Energy and Natural Resources, responsible for the utilization, development, management and protection of Alberta's forest resources; Alberta Economic Development, which oversees product and market development and encourages industrial development in Alberta; and the Alberta Research Council, which conducts the forest products research program and acts as technical consultant to both Energy and Natural Resources and Economic Development.

As a result of recommendations by an advisory committee representing the three government agencies, industry and the University of Alberta, a permanent Forest Products and Forest Industrial Development Research Program was created on April 1, 1982. The Alberta Research Council was chosen to house the new program because of its mandate, structure and rapport with industry and because a forest products research and development program was already incorporated into the Alberta Research Council's long range plan.

During 1982/83 a modest laboratory for testing and forest products development was established at the Alberta Research Council's Parsons property building in Edmonton. Additional testing capability was provided in 1983/84. The laboratory was accredited as a testing agency by Canada Mortgage and Housing Corporation in 1983.

Management Committee

The Ministers of Energy and Natural Resources and Economic Development and the President of the Alberta Research Council agreed upon the following terms for the operation of the Management Committee.

- the committee will consist of the Assistant Deputy Minister (or his designate) from each department and the Vice-President Industrial and Engineering Research Division (or his designate) from the Alberta Research Council;
- the Assistant Deputy Minister of Energy and Natural Resources will act as chairman of the Management Committee;
- based on proposals made by or acceptable to the committee, the committee will agree in principle on the broad scope of the long-term Forest Products and Forest Industrial Research and Development Program to be carried out.

The committee will meet periodically to review progress and to agree upon the projects that will make up the research and strategic studies program for the one-year period immediately following. A review of the previous year's progress will also be carried out.

Once agreement has been reached on the list of projects for the next one-year period, arrangements will be made by Energy and Natural Resources to transfer to the Alberta Research Council and Economic Development the funds necessary for carrying out their respective projects for the year.

The committee shall be responsible for coordinating all government funded research pertaining to forest products and forest industrial development.

On March 31, 1984 the Management Committee members were:

Alberta Energy and Natural Resources
Mr. J.A. Brennan
Assistant Deputy Minister
Alberta Forest Service

Alberta Economic Development
Mr. K.H.G. Broadfoot
Assistant Deputy Minister
Development and Trade

Alberta Research Council
Dr. D.L. Mitchell
Vice-President
Industrial and Engineering Research Division

Nonvoting members on the Management Committee were:

Mr. B.W. Karaim (Secretary)
Forest Products Advisor
Alberta Forest Service

Mr. R.G. Anderson
Director
Forest Industries Section
Alberta Economic Development

Dr. L. Bach
Manager
Forest Products Program
Alberta Research Council

Mr. A.A. Roehl
Head
Materials and Testing Department
Alberta Research Council

Program objectives and guidelines

The Forest Products and Forest Industrial Development Research Program has three basic objectives:

- to increase and improve the commercial utilization of Alberta's forest resources;
- to promote and support research into the development and efficient use of Alberta's existing and potential forest resources;
- to encourage the development of Alberta-based scientific and technical expertise in the field of forest products.

Proposals for specific research projects are reviewed and assessed within the context of the following guidelines. Eligible research projects shall include those relating to resource and industrial development assessment, forest products, production, marketing, transportation, and utilization of Alberta's forest resources.

Preference will be given to applied or mission-oriented research projects, although some consideration will be given to funding of appropriate basic research projects.

Consideration will be given, under certain circumstances, to proposals for construction of new or improved physical facilities for forest products related research in Alberta.

The Alberta-based private sector will be encouraged to participate in the program, through submission of appropriate research proposals and through its advice as requested.

Most approved projects will be carried out under a legal agreement between Alberta Energy and Natural Resources, Alberta Economic Development or the Alberta Research Council and the researchers, specifying the terms and conditions under which the research funds will be expended, and under which the technology will be disclosed, owned and licensed.

Those interested in further information about this report or any of the project summaries featured on the following pages are invited to address their requests to:

The Chairman,
Forest Products and Forest Industrial Development Research Program
Alberta Energy and Natural Resources
10th Floor, South Petroleum Plaza
9915 - 108 Street
Edmonton, Alberta
T5K 2C9

Strategic studies projects

Project title:
A study of Alberta's secondary forest products manufacturing industry

Objectives:
- To identify the current status of manufacture and consumption of secondary solid wood products in Alberta
- To identify the existing and the potential market for secondary manufactured solid wood products in Alberta
- To evaluate the opportunity for government initiatives to encourage improved utilization of the indigenous species in Alberta for secondary manufactured products

Project responsibility:
Alberta Economic Development

Investigators:
Hallmark Engineering Ltd. and Woodbridge, Reed and Associates Ltd.

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
- The secondary forest products manufacturing industry provides direct employment for about 5500 Albertans and has annual sales of $400 million.
- The industry imports the major part of its raw materials from other provinces, the U.S. and overseas.
- There are a number of products that could be manufactured from Alberta wood species such as unfinished pine furniture, interior shutters, laminated boards, interior panelling, more machine stress rated (MSR) lumber and lumber in home center sizes.
- The majority of products are consumed in Alberta.
- Although a number of products are directly related to the health of the housing industry and are thus in a state of overcapacity, there are a few products with growth potential such as windows, doors, furniture and to some extent kitchen cabinets.

Implications:
Identification of secondary manufacturing development opportunities in Alberta.

Conclusions:
- There is potential for export to Europe of higher-value lumber grades and dimensions.
- An Alberta particleboard or medium-density fiberboard (MDF) plant would have a significant market in Alberta.
- There is growth potential for some product lines such as windows, doors, furniture, kitchen cabinets and lumber, but economic feasibility studies on a product-specific basis would be required.

Further work:
Product-specific feasibility studies.

Project title:
Market assessment for poplar products

Objective:
To determine both the existing and potential markets for products manufactured from the poplar resource of western Canada

Project responsibility:
Alberta Forest Service

Investigators:
Carroll-Hatch (International) Ltd.

Source of funding:
Forest Products and Forest Industrial Development Research Program (25 percent); British Columbia government (25 percent); federal Department of Regional Economic Expansion (50 percent)

Results as of March 31, 1984:
- Bleached aspen sulfate pulp can be as good as or better than the standard North American mixed hardwood pulp for most applications. A mill located in Alberta could supply the mid-western and western U.S., as well as some Asian countries.
- Bleached aspen sulfate pulp would be equivalent to birch pulp in certain applications and at least as acceptable as European birch in all paper and paperboard products.
- Aspen is a preferred species for BCTMP and a market exists in the U.S. for tissue and sanitary grades; Japan and western Europe are also potential markets.
- The short-term prospects for a newsprint mill, (1984-87) in Alberta or B.C. appears to be unfavorable due to existing overcapacity. However, prospects look better after 1987. Markets would be U.S. midwest and western regions and joint venture would be the most profitable arrangement.
- The opportunity to develop a market for output of at least two new machines producing light-weight coated (LWC) mechanical papers in western Canada appears to be excellent in the latter half of the 1980s.
- Medium-density fiberboard (MDF) should receive a high priority for any future development in Alberta. Potential markets are Canada, Japan, southeast Asia and western Europe.
- Thin particleboard appears to show potential for a plant in Alberta or B.C. to serve Asian and U.S. markets. Raw material should be residues from sawmills.
- Select high-quality lumber from aspen appears feasible provided there is an outlet for the high volume of residues and the sawmill is designed for quality recovery rather than quantity throughout.

Implications:
Identification of potential products and markets which can be supplied from the poplar resource in Alberta and B.C.

Conclusions:
- Several products (selected pulp and paper products, medium-density fiberboard (MDF), thin particleboard and lumber) manufactured from poplar appear to have potential for successful marketing.
- The final decision regarding the manufacture of any of these products requires detailed feasibility studies.
- Any industrial development based on poplar should be designed to utilize all of the material harvested by clear cutting.
- The government has two choices: 1) leave poplar development completely to market forces, or 2) undertake detailed product and site specific feasibility studies supplemented with financial assistance programs.

Project title:
Competitiveness of the Albertan versus the southeastern U.S. forest industry

Objective:
To determine the comparative feasibility of an integrated forest industry complex in Alberta versus a similar complex in southeastern U.S.

Project responsibility:
Alberta Economic Development

Investigators:
Jaakko Poyry International Oy

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
- Annual allowable cut (AAC) estimated at 2 million m^3 of which 61 percent is hardwood and 39 percent softwood.
- Due to presence of muskeg 75 percent of logging must be done in the four winter months.
- Bleached aspen kraft pulp would be of high quality compared to other hardwood pulps in the U.S. and pulp quality would not be sensitive to stain and decay.
- High quality lumber, kraft pulp or mechanical pulp can be produced from Athabasca softwoods. Mechanical pulp would be best suited for newsprint and LWC paper.
- A combination of both softwood and hardwood pulps, which could be produced from the Athabasca area, would be best suited for wood-free printing and writing papers.
- Global demand growth prospects are best for LWC paper and wood-free printing paper.
- Capital costs are about 17 percent higher in Alberta than in the U.S. south, but both fuel and power are 50 percent less in Alberta.
- ROI (return on investment) for all products covered was higher for an Alabama mill than an Alberta mill.

Implications:
Recommendation of an optimum integrated development for the Athabasca forest.

Conclusions:
The wood-free printing and writing paper mill complex offers the highest return on investment (17.2 percent) for Athabasca site.

Further work:
More detailed forest resources and feasibility studies by private sector.

Project title:
CTMP of aspen in various states of decay

Objective:
To determine the influence of wood quality on pulp strength and bleachability when aspen is pulped via the CTMP process

Project responsibility:
Alberta Forest Service

Investigators:
Sunds Defibrator AB

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
- 2275 kg of aspen of mixed quality were shipped to Stockholm, Sweden for pulping in a CTMP pilot plant.
- The density and related properties (e.g., tensile index) were the same for pulp of clear and stained logs, but an impairment was obtained when logs in the incipient and advanced states of decay were used.
- The tear index deteriorated only for advanced decay.
- CTMP produced from an equal mixture of the four log types gave strength properties comparable to those of logs in an incipient state of decay.
- The pulp yield determined from chemical oxygen demand (COD) released was about the same for all pulps (88-89 percent).
- Peroxide bleaching with 40 kg/t H_2O_2 reduced the yield by 2.5-3 percent for all pulps.
- The energy consumption to a freeness of 125 mL Canadian Standard Freeness (CSF) was 1700-1800 kWh/odmt.
- Brightness of pulp made from logs in an advanced state of decay decreased 18 points.
- Incipient decay produced a brightness drop of 10 points.
- Peroxide bleaching with 40 kg/t H_2O_2 resulted in a brightness of 78 percent International Standards Organization (ISO) for clear aspen while stained, incipient decay and the mixture reached 70-71 percent and advanced decay 66 percent ISO.
- Bleaching improved the strength properties equally for all pulps (i.e., about 20 percent in tensile and 10 percent in tear index).
- An increase of the alkali charge from 20 to 50 kg/t NaOH improved the tensile index by almost 100 percent and reduced the energy consumption by 30 percent. The drawback was low bleach response and poor opacity.

Implications:
CTMP could provide an opportunity to extend utilization of aspen.

Conclusions:
- Only the advanced decayed aspen gave lower strength pulps. All others were equal in strength.
- Based on bleached brightness it would appear that only clear aspen is suitable for printing-grade paper.

Further work:
None anticipated.

Project title:
Drying performance of aspen lumber treated with water-soluble polymers

Objective:
To dry commercial-sized lumber treated with three different water-soluble polymers and to note drying performance in comparison to untreated controls

Project responsibility:
Alberta Forest Service

Investigation:
Aditi Research Ltd. and Forintek Canada Corp.

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
- The overall quality of the wood used in the tests was poor. Large areas of rot or defect-prone, discolored wood were present in more than half of the total shipment.
- Areas of clear wood, however, dried with virtually no defects.
- Thickness variation was excessive — 2 x 6 ranged from 1.5 - 2.3 in and 1 x 6 ranged from 0.8 - 1.4 in. Consequently, very little restraint against warp could be provided by the stickers.
- In general there was no clear or consistent trend of any treatment being markedly effective in reducing defects.

Implications:
Development of much cheaper more effective wood treatment processes would increase utilization of lower-grade species such as poplar.

Conclusions:
- The results suggested that some of the treatment provided a measure of defect prevention, although consistent trends were not evident.
- The major defect was warp; however, the lack of sticker restraint caused by uneven thickness of the lumber may have masked the effect of treatments.

Further work:
The experiment should be repeated using more effective polymers developed after this study was underway and with emphasis placed on selecting sound, well-sawn lumber so that treatment effects alone can be examined without influence of extraneous factors.

Project title:
Processing of Alberta aspen into Japanese veneer and plywood

Objective:
To determine the technical and economic feasibility of using Alberta aspen to produce Japanese veneer and plywood

Project responsibility:
Alberta Forest Service

Investigators:
Shimane-ken Plywood Association, Mitsue, Japan

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
- 484 m^3 of aspen logs were shipped to Japan in June 1983.
- All of the logs contained some degree of rot.
- Bark was hard and debarking was difficult.
- Japanese peeled 6 thicknesses of veneer — 0.55 mm, 0.75 mm, 1.5 mm, 1.85 mm, 2.40 mm and 3.20 mm.
- Fluffy dust rose on the veneer surface plugging the lathe blade.
- Lathe rotation had to be reduced 50 percent.
- The thin veneers puckered on drying and made gluing difficult as delamination became a problem. However, Japanese could resolve with incising at lathe head and roll drying.
- Aspen veneer was weaker than other hardwood species used in Japan.
- Yield from aspen logs was about 38 percent compared to 65 percent for other hardwoods used.
- Out of a trial run of 121 sheets of 9 mm x 900 mm x 800 mm, 50 percent was graded JAS A, 39 percent JAS B and 4 percent was rejected.
- Adhesion tests conducted revealed that aspen plywood can fully meet the JAS T-2 requirements.
- Fifty sample sheets were sent to Alberta for evaluation by Alberta Research Council.

Implications:
Successful processing and marketing trials in Japan could result in new development opportunities in Alberta.

Conclusions:
- Aspen is suitable for Japanese plywood production.
- Color is white and very attractive, also lightweight and sands well.
- Due to its lower strength, aspen is best used for Class Two Structural Plywood, furniture LVL, food containers or for core material in plywood thicker than 9 mm.
- Logs should be processed as soon as possible in order to avoid the advance of stain particularly on the log ends, and they should be processed in country of origin if feasible.

Further work:
Examine and test samples at Alberta Research Council laboratory.

Project title:
Feasibility of producing mechanically laminated wood beams from aspen and softwood lumber.

Objectives:
to examine methods and techniques for manufacturing mechanically laminated beams using two-sided connector plates; to assess the behavior of these beams when manufactured from kiln dried SPF lumber, lodgepole pine lumber and green aspen lumber; to examine the influence of span to death ratio and plate spacing on beam performance; to assess the economics of producing mechanically laminated beams for construction

Project responsibility:
Alberta Forest Service/Alberta Department of Housing

Investigators:
Morrison Hershfield Ltd.

Source of funding:
Forest Products and Forest Industrial Development Research Program — (50 percent) and Innovative Housing Grants Program — (50 percent).

Results as of March 31, 1984:
- A total of 31 beams were constructed from nominal 2 x 4 lumber using double-sided steel plates.
- The deflection of the mechanically laminated beams at all load levels was greater than the deflections predicted for a similar idealized solid beam. This increased deflection was likely due mainly to the slip of the connector plates.
- An increase in the amount of plate in a given beam resulted in a decrease in deflections. The 14′-8″ span SPF increase about 13 percent in ultimate strength as the amount of plate was increased from 56 to 84 feet.
- The vertical and horizontal distribution of a given amount of plate, based on the shearing stress distribution in a solid beam, resulted in smaller deflections than with a stacked arrangement of the same amount of plate.
- The relative influence of plate slippage (through shear) on deflections and strength became less important as the slenderness of the mechanically laminated beam increased.
- The ultimate load that a mechanically laminated beam was capable of carrying was similar to that of a solid beam if the beam were constructed with sufficient plate to limit slip deflections to practical levels. The ultimate load can be increased by placing the stiffest and strongest laminations toward the top and bottom of a beam, but particularly in the bottom (i.e., tension zone).
- The failure mode of the beams changed from a shearing related slip failure to a bending induced tension failure as the amount and efficiency of distribution of plate increased.
- The strengths and stiffnesses of beams constructed from SPF and lodgepole pine lumber were similar. Aspen beams were roughly 20 percent less efficient in strength and stiffness than the other two species.

Implications:
Possible new uses for machine stress rated lumber manufactured in Alberta. Also added opportunity for truss manufacturers.

Conclusions:
- Preliminary economic analysis indicates that for spans less than 20 feet the mechanically laminated beam would not be competitive with 2 x 12 Douglas-fir joists.
- At spans of more than 30 feet the mechanically laminated beam would be less cost effective than open web steel joists.
- However, it would appear that in the span range from 20 to 30 feet the mechanically laminated beams may be competitive with open web steel joists and are less costly than glulam or microlam products.
- It was not possible to predict mechanical laminated beam behavior as a function of span, loading, beam dimensions, component lumber and plate distribution for two reasons — 1) The beams were not tested with enough replications in each series to be considered statistically significant; 2) some important parameters such as beam dimensions were not varied in a sufficient number of test series.

Further work:
No further work anticipated unless economics change and industry decides to move into commercial production.

Forest products research and development projects

Project title:
Establishment of a forest products testing and development laboratory at the Alberta Research Council

Objective:
To provide capability in Alberta to perform standard, physical, mechanical and chemical testing of wood and forest products manufactured in Alberta

Project responsibility:
Alberta Research Council

Investigators:
Alberta Research Council staff

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
The testing capability at the Alberta Research Council's Parsons facility was expanded.

- Computer aided data acquisition system was installed on our structural panel testing equipment.
- Concentrated loading and impact loading equipment for performance testing of floor/roof systems according to the requirements of the American Plywood Association was designed and constructed.
- Uniform distributed loading equipment for panel products was designed and construction was initiated.
- The prototype machine stress rating equipment for panel products was extensively tested. A very good correlation was found between fast stiffness measurement of the 'MSR prototype' and the slow, but accepted, 'Post Flexure Machine.'
- Creep loading test equipment for structural panel products was designed and constructed, and preliminary testing initiated.

Implications:
The Alberta Research Council is now able to assist the Alberta forest products industry with most standard tests pertaining to wood-based building materials. Canada Mortgage and Housing Corporation (CMHC) has accredited the Alberta Research Council's Forest Products Testing Laboratory.

Conclusions:
Alberta now has a recognized forest products testing laboratory ready to serve the Alberta industry.

Further work:
Continue to build up the forest products testing and product development capability in the following areas: 1) reconstituted wood products, 2) non-destructive testing of panels, 3) wood impregnation.

Project title:
Conceptual engineering design for an on-line machine stress rating (MSR) system for panel products

Objective:
- To develop a conceptual engineering design for an on-line automated MSR system to measure stiffness of full-sized panels. The study is to be performed in sufficient detail to permit cost estimates of the final design.
- To produce layout drawings of the placement of the MSR system in manufacturing plants when used for 1) panel grading or 2) quality control

Project responsibility:
Aberta Research Council

Investigators:
Columbia Engineering International Ltd. and Alberta Research Council

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
During 1982/83 Alberta Research Council acquired prototype equipment for non-destructive stiffness testing of panel products. During 1983/84 the Alberta Research Council conducted successful evaluations of the equipment in the laboratory and in panel manufacturing plants. A report was prepared by a consulting engineering company, covering:
- conceptual mechanical design and equipment pricing for dynamic on-line testing of panel products.
- conceptual electrical design and equipment pricing for on-line MSR system for panel products.
- conceptual locations of stress rating machines in industrial scale panelboard plants.

Implications:
The studies done were adequate for the purpose of getting quotations from companies that have the capability to prepare the final design and construct prototype on-line MSR equipment.

Conclusions:
The technical and preliminary cost data for the construction of an on-line MSR system for panels are now available.

Further work:
Move ahead and obtain firm quotations for the cost of constructing an on-line MSR prototype system for panel products after a decision on the continuation of the project has been made.

Project title:
Engineering feasibility concept for the manufacture of corrugated waferboard

Objective:
- to perform engineering feasibility studies for manufacturing corrugated waferboard
- to design and construct a set of press plattens for laboratory manufacturing of 2′ x 4′ corrugated panels

Project responsibility:
Alberta Research Council

Investigators:
B.S.L. Machine Ltd. and Alberta Research Council

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
Report completed. According to well-established engineering mechanical theories, the panel stiffness and load carrying capacity can be greatly improved by using a corrugated rather than a flat profile without using more material:

- A concept for the manufacture of corrugated waferboard has been developed.
- A set of press plattens has been designed and manufactured.

Implications:
Substantial improvements in the performance of waferboard could place the Alberta panel industry in a leadership position.

Conclusions:
The work performed to date looks encouraging and should be continued.

Further work:
- Acquire a panel press and manufacture laboratory panels with the new plattens.
- Examine the patent position with regard to this development.
- Patent search is underway.

Project title:
Chemical characterization of Alberta aspen

Objective:
To study fundamental aspects of the wood chemistry of aspen, in particular lignin chemistry of interest for potential applications

Project responsibility:
Alberta Research Council

Investigators:
Alberta Research Council staff

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
Two progress reports were issued. The work in 1983/84 was covered:

- the content of lignin, cellulose and hemi-cellulose in clear, stained, intermediate decayed and advanced decayed aspen wood.
- the chemical characterization of aspen derived lignin has been initiated (periodate lignin, dioxane lignin, klason lignin).

Implications:
This study indicates that it may be more economical to extract aspen lignin from decayed aspen than from healthy aspen.

Conclusions:
This involvement in aspen wood chemistry has proven to be of interest to industries concerned with the chemical utilization of aspen.

Further work:
Continue work on the basic properties of aspen lignin with product development in mind.

Project title:
Effects of aspen bark as a filler in polymer composites

Objective:
- To prepare polyurethane, phenol formaldehyde, polyvinyl chloride (PVC) and polypropylene samples using granulated aspen bark as a filler
- To test the physical mechanical properties of the above samples with various amounts of bark filler

Project responsibility:
Alberta Research Council

Investigators:
D.J.F. Polymer Consulting Ltd.

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
The report concludes:
- The use of aspen bark to lower the cost of rigid polyurethane foam is practical and could be expected to attract industrial attention.
- Rigid PVC could benefit substantially in terms of lower cost from inclusion of aspen bark.
- The decomposition temperature restricts moulding with bark filler in polypropylene.
- Aspen bark filler could be a partial displacement for wood flour filler in phenol formaldehyde.

Implications:
Potential new business opportunities for the Alberta plastics industry.

Conclusions:
Potential for granulated bark as filler in plastics has been demonstrated.

Further work:
Explore the economical feasibility for specific applications in cooperation with the Alberta plastics industry, Alberta Economic Development and the Northern Alberta Institute of Technology.

Project title:
Product testing of 6.0 mm, 7.5 mm and 11.0 mm oriented strand board

Objective:
To test 6.0 mm, 7.5 mm and 11.0 mm oriented strand board according to accepted Canadian codes and standards

Project responsibility:
Alberta Research Council

Investigators:
Alberta Research Council staff

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
Project completed and reports submitted to the client.

Implications:
The client used these reports as part of a submission to Canada Mortgage and Housing Corporation to have the tested products accepted as structural panels.

Further work:
The panel products are now to be re-evaluated according to new codes and standards under development.

Project title:
Strength properties of 9.5 mm (3 ply) and 15.5 mm (5 ply) western white spruce sheathing grade plywood

Objective:
To generate the test data required for a submission to CSA-086 for allowable unit stress for Alberta produced plywood

Project responsibility:
Alberta Research Council

Investigators:
Western Plywood Manufacturers Association and Council of Forest Industries of British Columbia

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
Report completed. The following engineering data were obtained and reported:

- Modulus of rupture
- Ultimate stress in tension
- Ultimate stress in compression
- Ultimate stress in shear through thickness
- Ultimate stress in planar shear (shear in plane-of-plies)
- Bearing stress at proportional limit
- Modulus of elasticity in flexure
- Modulus of elasticity in tension
- Modulus of elasticity in compression
- Modulus of rigidity in shear through thickness
- Modulus of rigidity in planar shear
- Modulus of elasticity in bearing.

Implications:
Publication. Allowable unit stresses for Alberta produced plywood will substantially assist the marketing attempts for Alberta produced plywood in Canada and overseas.

Conclusions:
This could result in allowable unit stresses for spruce plywood.

Further work:
Assist the plywood industry with quality assurance according to CSA-0151 for the plywood produced in Alberta.

Project title:
Post flexure and machine stiffness rating of 5/16", 3/8", 7/16", 1/2", 5/8", 3/4" oriented strand board

Objective:
To determine the bending stiffness and strength of the initial production runs of oriented strand board

Project responsibility:
Alberta Research Council

Investigators:
Alberta Research Council staff

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
Project completed and reports submitted. Baseline values were established, enabling the client to evaluate the effects of process changes to their original products.

Implications:
Technical and economical optimization of the production parameters were made possible based on the test results obtained.

Conclusions:
The testing capability available at the Alberta Research Council can provide useful support to Alberta industries.

Further work:
None anticipated unless requested by company.

Project title:
Performance testing of oriented strand board and Canadian softwood plywood supplied to Alberta Research Council by an industrial client

Objective:
To provide data for verification of similar testing performed by another testing agency

Project responsibility:
Alberta Research Council

Investigators:
Alberta Research Council staff

Source of funding:
Forest Products and Forest Industrial Development Research Program

Results as of March 31, 1984:
Project completed and report submitted to client.

Implications:
The data were used by the client as part of a submission to Canada Mortgage and Housing Corporation.

Conclusions:
The test methods used and results obtained were acceptable to Canada Mortgage and Housing Corporation.

Further work:
None anticipated unless requested by company.

List of Published Reports

1979 The preliminary evaluation of the market for Alberta kraft pulp, by Kearney Management Consultants Ltd. Free on request.

1979 Energy and chemicals from wood, by SNC Tottrup and Associates. Free on request.

1980 A directory of primary wood-using industries in Alberta, 1979 by Canadian Forest Service and Alberta Forest Service. Free on request.

1982 Evaluation of the hardwood resource in the O'Chiese block, by Pedology Consultants and D.A. Westworth and Associates. Free on request.

1982 Analysis of poplar based panelboard development program options for Alberta, by Carroll-Hatch (International) Ltd. Available for the price of $10.

1982 Poplar chemical process development and demonstration facility, by W.L. Wardrop & Associates Ltd. Available for the price of $15.

1982 Annotated bibliography of the relevant literature on the utilization and properties of western Canadian poplars, by Forintek Canada Corp. Free on request.

1983 Forest research needs for the management of aspen and poplar in Alberta, by W.R. Dempster and Associates Ltd. Free on request.

1983 To review the pulp chip pricing system in Alberta, by Bowell Consultants Ltd. Free on request.

1983 A study of Alberta's secondary forest products manufacturing industry, by Hallmark Engineering Ltd. and Woodbridge, Reed and Associates Ltd. Free on request.

1983 Market assessment for poplar products, by Carroll-Hatch (International) Ltd. Free on request.

1983 Competitiveness of the Albertan vs. the U.S. southeastern forest industry by Jaakko Poyry International Organization. Free on request.

1983 Newsprint from Alberta woods, by CIP Research Ltd. Free on request.

1983 Bleached CTMP from decayed and stained aspen logs, by Woodbridge, Reed and Associates, and Econotech Services Ltd. Free on request.

1983 To assess new drying methods for aspen lumber, by Forintek Canada Corp. Free on request.

1983 To demonstrate ways of upgrading Alberta sawmills, by Forintek Canada Corp. Free on request.

1983 Chemical characterization of aspen wood — clear, stained and decayed trees, by N. Cyr, Alberta Research Council. Free on request.

Summary of expenditures

Pursuant to the terms of the five-year agreement with the Alberta Research Council, a sum of $881,800 was transferred from Alberta Energy and Natural Resources to the Alberta Research Council by March 31, 1984 in support of the forest products research and development program. The Alberta Research Council contributed a further $75,000 for a total 1983/84 annual forest products research and development program budget of $956,800. As of March 31, 1984 expenditures on approved projects were $736,100.

The forest industrial development part of the program received funding in the amount of $206,000. Expenditures on approved projects as of March 31, 1984 were $196,200.

The total allocated to both subprograms was $1,162,800 and total expenditures on approved projects as of March 31, 1984 were $932,300.